

Rubric for Performance Indicators of Student Outcome (b):

An ability to design and conduct experiments, as well as to analyze and interpret data

Performance Indicator	1: Beginning	2: Developing	3: Proficient	4: Exemplary
Design an Experiment Plan	<ul style="list-style-type: none"> • Missing Experiment Plan • Missing Driving Question • Missing identification of key variables • Missing data collection procedure 	<ul style="list-style-type: none"> • Flawed Experiment Plan • Weak Driving Question • Majority of key variables are not identified • Data collection procedure is formulated poorly 	<ul style="list-style-type: none"> • Adequate Experiment Plan • Driving Question is presented, though it might have minor flaws • Almost all variables have been identified • Data collection procedure is formulated adequately, but does not account for all externalities 	<ul style="list-style-type: none"> • Well thought out Experiment Plan • Driving Question is appropriately narrow and focused • All relevant variables and externalities have been identified • Data collection procedure is detailed without being unnecessarily complicated
Acquire data on appropriate variables	<ul style="list-style-type: none"> • Data acquisition appears to have significant errors or unrealistic accuracy (fake data?) • Data collected for variables that are not part of Experiment Plan or some variables are not sampled • Missing large portions of data range 	<ul style="list-style-type: none"> • Data acquisition does not include any detail on instrument precision or accuracy performance (sensitivity & calibration) • Acquired data is not accompanied by a data acquisition illustration or diagram (test setup not adequately described) • Input data range is significantly limited or obviously meaningless for some variables 	<ul style="list-style-type: none"> • Data acquisition includes most instrument capabilities (sensitivity & calibration) • Data acquisition setup is illustrated / explained, but a few minor details are missing • Input data covers most of the “range of interest” for the key variables 	<ul style="list-style-type: none"> • Data acquisition includes all relevant sensitivity and calibration information • Data acquisition setup is carefully and thoroughly explained • Input data covers entire range of interest, as well as some additional points / configurations that might be of interest without wasting time on unnecessary procedures

<p>Compare experimental data and results to appropriate theoretical models</p>	<ul style="list-style-type: none"> • No comparison made, or comparison made to nonsensical models 	<ul style="list-style-type: none"> • Weak comparison of data to appropriate model • Comparison of data made to model that doesn't include some important relationships among key variables 	<ul style="list-style-type: none"> • Adequate comparison made to appropriate model • Model includes important relationships among key variables, though some minor details are missing 	<ul style="list-style-type: none"> • Thorough comparison conducted between sufficiently varied data set and detailed model • Theoretical model is sufficiently detailed to provide insight into Driving Question
<p>Explain observed differences between model and experiment (bad model, bad measurements, noise, etc.)</p>	<ul style="list-style-type: none"> • Differences are not identified or are incorrectly explained • Neither the possibility of using the wrong model nor of collecting erroneous data has been identified 	<ul style="list-style-type: none"> • Most differences are correctly identified, but many are poorly explained • Explanation of differences does not consider use of wrong model or possibility of having erroneous data 	<ul style="list-style-type: none"> • All major differences are identified; only a few minor differences have been ignored • Both model and data have been explored as possible sources of error 	<ul style="list-style-type: none"> • All relevant differences have been identified • Potential weaknesses in both model and data collection procedure have been identified, but both are well done